GAS JOURNAL, APRIL 10, 1946

VOL. 247 98th YEAR No. 4325

DOMESTIC FUEL POLICY

PRESSURE on our space has prevented our referring editorially till now to an important document, "Heating and Ventilation of Dwellings," the report of a Committee set up in 1942 with Sir Alfred Egerton as Chairman. The report runs to 250 pages of closely typed print. It comes under the aegis of the Ministry of Works, and is No. 19 of a series of reports on post-war building studies, several of which we have mentioned in these columns previously. This recently issued report claims to give a broad view of the whole situation, and claims also to add revealing details. It certainly contains a vast amount of data which should prove of immense value to anybody concerned with the provision of heat to dwelling-houses. Heat to dwelling-houses includes the provision of cooking facilities, supply of hot water for all the various purposes for which hot water is used, the oddments of clothes airing and so on, quite apart from the general supply of heat to combat the variable climatic conditions of our country.

These variable climatic conditions have been discussed in these columns from many angles in the past, yet their complications obviously remain, and comparatively little has been done fundamentally (we are thinking of the house as a structure) to make the home comfortable—not only for the man who occupies it for a short period in his leisure hours, but for the housewife, who occupies it for most of her working life in her working hours. We have had much to say about the lack of insulation of houses, and this latest report of the Ministry of Works attacks the problem anew, collecting statistics from all manner of sources, setting them out with lucidity and clarity.

It will have been gathered from our previous comments on the subject of heat provision for domestic dwellings that we consider the question of insulation of British homes as one of no small importance. The report states that "the coal consumed in heating our houses to-day is about 63,000,000 tons, which would equal the capital cost of 300,000 houses." Should we not, therefore, give some small consideration to the conservation of heat in building the potential houses of this exhilarating post-war period? Such insulation, carried out with reasoned advice, would reduce the fuel bill for the occupant, and it would also reduce the amount of coal which has to be mined. Every day we learn from Parliamentary debates and the like of the decreased output of coal from the mines, in spite of every exhortation from a nationalization-minded Government. Voluntary absenteeism from the mines is on the increase, and now that there is liberty to express a few facts relating to the progress of the country, it becomes obvious that strikes are not infrequent in the coal-producing areas. We suppose that a balance must be arrived at as to the expenditure on insulation, additional to the normal cost of the building, which can economically be justified on account of the saving in the heating cost. The Egerton report to which we have referred states that "no absolute criterion can be laid down," and with this statement there should be general agreement, for obviously the higher the thermal efficiency and the less expensive the fuel the less will be the saving attainable by insulation.

In the pre-war house of normal construction, the expenditure on space heating—and we are speaking of a small house—was in the neighbourhood of £10 a year. The cost of 1,000,000 B.Th.U. lost from the dwelling, according to the report, is about 8s. 4d.; and the report states that under normal conditions 24,000,000 B.Th.U. are lost annually from the structure. A chilly house implies moisture on walls, moisture on furniture, moisture on household linen. One has only to leave one's house for a relatively short period in the winter months to experience on return to the house a dampness to dispel which a considerable amount of fuel is needed. The whole problem could be solved easily if the temperature inside the house were prevented from falling below 45° to 50°F. This is by no means a high temperature, but it can be provided by a moderate degree of continuous warmth or background heating.

If dwellings were insulated and provision was made for background heating to maintain this comparatively low temperature, then the topping up by radiant heat by gas would be exceedingly economical.

An adequate supply of hot water is a necessity in any home. It encourages decent living. We find in the report of the Egerton Committee illuminating facts on the provision of a reasonable supply of hot water. For example, in one estate of 5,000 houses, an estate which until recently was without adequate hot-water supply, it was necessary to treat two or three houses every month to get rid of bugs. After the installation of an adequate and not necessarily expensive hot water supply, there has not been more than one case of this bug infestation a year. Elimination of bugs, however, is obviously not the major service which hot water can offer, and the point arises as to how much water is needed to fulfil more or less minimum requirements for a household of average family, which is in most statistical documents regarded as a family of four people—two adults and two children. According to the report the hot-water installation should be able to provide 250 gallons of water at 140°F. weekly. We take this as a minimum provision. Facilities should be provided to give a supply at 140°F. for washing dishes and for laundry purposes, and the means of conveniently bringing about 7 gallons of water to the boil. Obviously the Gas Industry can provide both fuel and equipment for these purposes. The quantity of water stated would provide about sufficient for a total of 7 baths a week, for 10 washes a day, for normal washing-up requirements, 10 gallons a week for cleaning the house, and some 50 gallons a week for laundry.

Naturally the report of the Egerton committee has a good deal to say on the subject of ventilation in dwellings, a problem obviously closely associated with that of heat requirements. It is rightly suggested that at times of peak usage of the cooker, and of any laundry equipment, it is almost impossible to prevent humidity in the kitchen rising to a marked degree, and consequently design cannot cope entirely adequately with this temporary condition. On the other hand, with moderate usage of kitchen appliances, it is considered that a ventilation rate of about 1,000 cu.ft. an hour is sufficient, and this corresponds to about two air changes per hour in an ordinary kitchen of the kind found in modern local authority housing, and is roughly enough for requirements of a kitchen in which cooking is done for a family of not more than six persons. For what we may term "complete ventilation" during the peak periods, we have mentioned there is little doubt that some form of forced or induced system of ventilation is desirable.

THE SIMON REPORT

WE turn now to a report of the Fuel and Power Advisory Council which was appointed by the Ministry of Fuel and Power in 1944. As a first term of reference the Committee was given the following: "To consider and advise on the use of fuels and the provision of heat services in domestic and similar premises, in the interests of the occupants and of the nation, with special regard to the efficient use of fuel resources and to the prevention of atmospheric pollution." The report in question is concerned entirely with this reference, and it comes

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as a corollary to the report of the Egerton Committee to which we have already referred. The Simon report sets out many recommendations addressed to the Government, accepting as a primary basis the standards of space and water heating laid down in the Egerton Report. The Simon Report maintains that the Government should encourage the provision of improved heating appliances for all fuels and for all domestic purposes, and that minimum standards should be rapidly established; and the Advisory Council urges that the manufacture and sale of new appliances falling below approved standards should be prohibited. The Council also urges that approved codes of practice on heating and ventilation installations should be adopted in all new houses, and that the Government should be responsible for establishing facilities for the testing of appliances, and take steps to secure the mass production of standardized domestic fuel appliances. The Council maintains that the main winter space and water-heating load should be taken by solid fuel, and that intermittent space heating and water heating for short periods should be taken by gas and electricity. This is a very broad statement, and underlying it all is the recommendation that the domestic heating field should be left for free competition between the various fuels. Again, as a main recommendation, the policy of the Government should be to replace bituminous coal in all house appliances by smokeless solid fuel as rapidly as adequate supplies can be provided at a reasonable price.

A significant observation regarding free competition between gas and electricity is that the prices charged for either commodity should be appropriately related to costs. In this connexion we recall the important Address given by Mr. A. E. Sylvester at a meeting of the Southern Association of Gas Engineers and Managers held in May of last year, in which Address he delineated his conception of the basis of gas costing and the charges for heating service given in relation to expansion of this service. We recall his insistence that load factor as affecting both manufacturing and distribution costs should be studied, so that comparisons might be appropriately drawn between one gas undertaking and another, and that there should be agreement on principles of assessment. We recall, too, the emphasis which he laid on the point that each class of consumer should contribute his fair share to the cost at which gas service can equitably be supplied to him. What, in effect, Mr. Sylvester asked was why consumers of particular classes of load should be penalized. This leads inevitably to the systems of charge adopted by the electricity industry, and to the query whether the charges made for the different domestic electrical loads bear any relation to the actual costs of supplying current for these particular loads, and to what extent what may appear to be temporary success within severely circumscribed limits is any true index of the future satisfaction of the electricity consumer.

In 1939 the average revenue for electricity for all purposes represented 1d. a unit. For domestic cooking and heating, tariff rates were available at ½d. a unit. At that time the electrical industry was meeting only 10% of the heating and cooking load carried by the Gas Industry. Domestic lighting represented some 25% of the domestic electrical load. To what extent were the charges made for the electric lighting load subsidizing the charges made for domestic cooking and heating loads? Again, it is pertinent to consider the rates charged for electricity for industrial power purposes. In 1939 many gas undertakings were paying well over 1d. a unit for current which provided the suppliers with an excellent load factor, the while these very gas undertakings were faced with electrical competition for domestic heating purposes at an inferior load factor at less than half the price. Is this sort of picture to remain unchanged? We turn again to the report of the Advisory Council and quote the following recommendation: "The outcome of the competition between gas and electricity and the influence exercised by the systems of tariffs upon the progress of the two industries should be kept under constant examination." As an addendum, the Council suggests that the Ministry of Fuel and Power should make arrangements for the collection of detailed statistics on this question.

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We have no intention of entering into great detail concerning the report in question, which is available to all at H.M. Stationery Office, but we would note that the Council asks that the Government should establish information centres in London and in principal cities in the regions, with skilled staffs of heating engineers, architects and scientists, and with showrooms where examples of all the best types of domestic heating appliances could be seen. Finally, we come to what we regard as perhaps the most important conclusion drawn by the Council regarding a long-term programme for diminishing smoke and increasing heating amenities in general; and here we quote from the report:

"It should be the target of a national domestic fuel policy to secure that the 50 million tons of bituminous coal now burnt with a working efficiency of 20% should be replaced in 20 years by smokeless solid fuel, or by bituminous coal burnt smokelessly, or by gas, or by electricity, with an average coal economy efficiency of not less than 40%. This would render possible the following results: The virtual abolition of domestic smoke; less labour and dirt in the house; and either doubling the useful heat to the smallerhouses at little or no greater cost to the householder and no increase in the consumption of coal; or an increase of 50% in the useful heat in the smaller houses with a substantial reduction in cost to the householder, and a saving to the nation of perhaps 10,000,000 tons of coal per annum."

"JOURNAL" SUBSCRIPTIONS.

The many new subscriptions ordered since January have temporarily brought us to the end of our paper resources, and we regret we cannot accept further orders for immediate delivery. A waiting list exists and we recommend early application.

Personal

Mr. GEORGE BREARLEY, B.Sc., F.R.I.C., has been appointed a Joint Managing Director of Brotherton & Co., Ltd.

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Mr. F. B. HALLIWELL, Distribution Engineer, Paisley Gas Department, has been appointed to a similar position with the Romford Gas Company.

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Mr. T. F. SCOTT, Technical Assistant to the Brighouse Gas Department, was, at a recent Investiture at Buckingham Palace, presented with the George Medal in recognition of his work with the Intelligence Service in Jugoslavia.

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Mr. G. M. GILL has resigned the position of Managing Director and Chief Engineer of the Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd., and has been appointed Consulting Engineer to the organization. He will remain a Director of the two Corporations, and of all their subsidiary Companies.

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Mr. H. C. HARRISON, Engineer and Manager of the Coleraine Gas Department since 1939, has been appointed Assistant Chief Engineer of the Alliance and Dublin Consumers' Gas Company, and will take up duty there in August. Mr. Harrison was trained at the works of the Belfast Gas Department.

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Mr. P. C. POPE, who has been Secretary of the Institute of Fuel from its earliest days, resigned on Mar. 1, and will in future act as Adviser to the Institute. In token of the energy and enthusiasm which Mr. Pope has always devoted to the Institute, and to fuel technology in general, the Council of the Institute have unanimously recommended him for election as an Honorary Member. Mr. R. W. REYNOLDS-DAVIES, B.Sc., M.I.Chem.E., F.S.S., has been appointed Secretary as from Mar. 1. He was appointed Deputy Secretary on Oct. 1. Receiving his technical education at University College, Cardiff, and the South Wales School of Mines, Mr. Reynolds-Davies has had wide experience as a chemical engineer and fuel technologist. His first industrial experience was obtained on the coke oven plant of the Cambrian Combine, now merged with the Powell Duffryn Associated Collieries, Ltd. He was later engaged as assistant with the late Dr. W. R. Ormandy on power alcohol and petroleum products. This work was followed by nine years as one of the chemical plant managers with British Industrial Solvents, Ltd. For the three years previous to his joining the Institute of Fuel he was Manager of the Development Department of the Royal Ordnance Factory at Bridgend.

Councillor T. P. RILEY, J.P., Chairman of the Walsall Gas Committee, has been selected by the Ministry of Education to visit Germany to interview prospective candidates for the teaching profession. Councillor Riley is headmaster of Great Wyrley Senior School, Staffs, and he has been granted three months' leave of absence from his normal duties to carry out this important work.

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Mr. C. STAPLES, who has been for many years head of the Technical Development Department of George Glover & Co., Ltd., of Chelsea, is retiring at Easter, on his 75th birthday. Mr. Staples was one of the pioneers in coin-freed apparatus as applied to gas meters, his activities in this direction going well back into the 1890's. His connexion with the firm dates from 1901, when his father's business was incorporated with that of George Glover & Co.

* * *

Mr. A. J. SUDUL, Commercial Manager of Falk, Stadelmann & Co., Ltd., retired on Mar. 31. He had completed 48 years' service, having started in 1898 as a ledger clerk. He was closely associated with the late Mr. Max Falk in developing the sales organization of the Company, and will continue to assist the Directors in a consultative capacity. Mr. Sudul has been presented with a gold watch from the Directors, and a bureau from his colleagues on the staff.

* * *

Mr. GEORGE BERRIDGE has been elected Chairman of the Board of the Romford Gas Company. Earlier in his life-long career in the Gas Industry, Mr. Berridge held appointments in the Midlands. He was appointed Secretary to the Romford Company in 1916, and has held successively the joint offices of Secretary and Commercial Manager, and Managing Director and Secretary. Mr. Berridge relinquished the Secretaryship in 1939, and has resigned the position of Managing Director following his election as Chairman.

* * *

Dr. H. ALEX FELLS, Chief of the Industrial Research Department of the Sheffield & District Gas Company since 1931, has left the Company and gone into practice as an industrial fuel consultant. A member of many technical societies and committees, Dr. Fells is one of the best known fuel technologists in Sheffield and South Yorkshire. He established the Industrial Research Department of the Sheffield & District Gas Company, and organized and equipped the laboratories, furnace development and demonstrations department in anticipation of the gas load expected through the Company's control of the South Yorkshire Gas Grid. His initial work was on fundamental research on the action of gases on metals, and this resulted in a series of patents on atmosphere control processes and furnaces which have had far-reaching effect in the precision heat-treatment of metals both in this country and abroad. Then followed a close study and application of the commercial and economic aspect of all types of fuels, resulting in great increases of the industrial uses of coke oven gas in the Sheffield steel industry. This work was of great benefit to Sheffield during the war, especially in the fuel economy campaign of the Ministry through his membership of the Industrial Gas Committee.

Obituary

Last Thursday morning Mr. JAMES G. GREENFIELD died at his home at Surbiton. Perhaps only a few of our oldest friends remember him in his book-keeping office at 11, Bolt Court. He retired in 1926 after 43 years' service to Walter King and the firm. "Jimmy" was the last of that "old brigade" whose work for the "JOURNAL" went back far into the last century. There were five of them—Bezant, Morris, Harrison, Blencowe, and Greenfield—and their years of service totalled 251.

Kitchen Planning in Yorkshire

The York, Harrogate, and District Group of Gas Companies opened an exhibition at the Guiseley Town Hall at which was shown that Group's model kitchen. The exhibition was opened by Dr. J. Outhwaite, J.P., Chairman of the Aireborough Urban District Council, and a large number of the Councillors were present. Dr. Outhwaite was supported by Mr. S. Parsons, Chairman of the Yeadon and Guiseley Gas Companies, together with Mr. A. McDonald, General Manager of the York, Harrogate and District Group of Gas Companies, and Mr. J. W. Rodgers, Sales Manager of the United Kingdom Gas Corporation.

The model kitchen is creating enthusiasm and interest, and there are many up-to-date appliances also on view. These include the Homepride drying cabinet, the Barspot gas and electric washing machine, the Howarth washing machine, and the new Yorkdale back-to-back coke range.

The exhibition will be re-erected in its entirety at the Yeadon Lecture Hall on April 24 and at the Mechanics' Institute, Otley, on May 20.

Proposed Glasgow Extensions

Evidence was given by Glasgow Corporation at a meeting of the Parliamentary Commission of Inquiry held in the city on April 3 and 4 covering plans for the development of the city gas and water undertakings. Powers to borrow £3,000,000 for the gas undertaking were asked by Mr. R. P. Morrison, K.C., appearing for the Corporation. He pointed to the fact that the last authorization had been in 1921, when £3,000,000 had been authorized. The new request would cover the period to 1961.

Limited borrowing for non-capital expenditure is also being asked. There was, Mr. Morrison indicated, no opposition to the proposals to borrow for gas and water development.

Evidence as to the essential nature of the expenditure now being sought was given by Mr. D. D. Burns, Commercial Manager of the Gas Department. The money required was, said Mr. Burns, essential for the maintenance and development of the city gas service.

Scottish Burghs Oppose Nationalization

The Scottish Convention of Burghs, meeting in Edinburgh on April 3, opposed the nationalization of the Gas Industry as not in the best interest of the consumer. A Port-Glasgow amendment to support nationalization, so long as local authorities maintain some control, was defeated.

"We have had too much theorizing about nationalization," said Mr. Alex Thorburn, Kirkintilloch. "Let us have some facts. Glasgow is a hundred times bigger than Kirkintilloch, yet we supply gas more cheaply than our big neighbour. There seems to be an idea that the bigger the unit, the more efficient it is, but I can show that the theory of nationalization is based on a fallacy."

Mr. Thorburn maintained that Scotland was quite a different proposition from England. In Scotland seven-eighths of the gas was supplied by local authorities. It already was a socialized industry. Over the Border, private enterprise provided twice as much of the gas as the local authorities.

Provost Charles Miniham, Port Glasgow, said that in the past his burgh had had to charge 7s. per 1,000 cu.ft. for gas, while Greenock charged 2s. 6d. It was all wrong, and unification should have come long ago. A questioner interjected: "Will Port Glasgow or Greenock subsidize us in Ross-shire, where we pay 10s.?" There was no reply.

Mr. James Hutcheon, Town Clerk of Dumfries, said they could not oppose the principle of nationalization, which was a policy of the Government. He criticized some of the local gas committees who had no technical knowledge, and suggested that the only way to get all-round efficiency was to subsidize the smaller units in providing new machinery and best expert advice. It was wrong that a householder on one side of the street should pay more for gas than a person on the other.

Diary

April 12.—Institution of Chemical Engineers: 24th Annual Corporate Meeting, Connaught Rooms, W.C. 2, 11 a.m.; Presidential Address, Hugh Griffiths, 12 noon; Luncheon, 1 p.m.

April 12.—North British Association of Gas Managers: Spring Meeting, Lesser Town Hall, Coatbridge, 10.30 a.m. Presidential Address, Mr. T. S. Lockhart, Rothesay.

April 15.—London and Counties Coke Association: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m., Gas Industry House.

April 16.—Midland Junior Gas Association: "Group Chemical Service," O. H. W. Boonham (Cheltenham).

April 17.—Gas Companies' Protection Association: Committee 5, Victoria Street, S.W. 1, 2.30 p.m.

April 17.—Industrial Gas Centres Committee: Gas Industry House, 10 a.m.

April 25.—Women's Gas Council: Executive Committee, Gas Industry House, 1 p.m.

April 26.—Manchester District Association of Gas Engineers: Annual Meeting; Presidential Address, G. E. Currier.

April 26.—London and Southern District Junior Gas Association: "Power Plant and Machinery for Exhausting and Boosting of Gas," L. J. Clark, Gas Industry House, 7 p.m.

April 26.—Southern Association of Gas Engineers and Managers (Eastern District): "The Place of the Gas Industry in the National Fuel Economy," Dr. G. E. Foxwell, Gas Industry House, 2.30 p.m.

April 27.—Manchester and District Junior Gas Association: Visit to Liverpool; Discussion on Report of the Gas Installations Committee (Ministry of Works Post-War Building Studies, No. 6), to be opened by R. J. Rogers, Chairman of the Committee.

April 27.—Scottish Junior Gas Association (Eastern District): Visit to a Colliery of the Fife Coal Co., Ltd.

April 30.—Institute of Fuel: Whole Day Conference on Waste Heat Recovery, Burlington House, Piccadilly.

Exit Mr. Yoshihara

A Record of the Experiences of the British Staff of the Shanghai Gas Company

From J. K. SIMPSON,

Engineer-in-Chief

THE sound of gunfire at 3.45 a.m. on Dec. 8, 1941, when the Japanese Naval forces sank the solitary British gunboat, the Peterel, in the Whangpoo River, was the first indication in Shanghai that war had begun. The Peterel went down on fire with the guns blazing.

Japanese tanks, armoured cars, armed motor cycles, lorries jammed with troops, were all over the city. Machine guns were trained on the gas-works gates, and sentries were placed at all vulnerable points on our plant. The notorious Bridge House, Headquarters of the Japanese Gendarmerie, was very soon busy and full of prisoners.

Our Japanese supervisor afterwards told us that the details of the occupation of our plant had been prepared some years ago, principally on the basis of information received from a Japanese employee. Our supervisor, Mr. Murayama, was Chief Constructional Engineer to the Tokyo Gas Company. He was soon superseded by the new manager, Mr. Yoshihara, who came with a large staff of 25 Japanese experts, compared with our skeleton staff of 8 British technical men and an accountant. The Japanese took our cars, limited our spending to the equivalent of £15 per month, and made us wear red arm-bands with markings indicating the nationality and the individual. We were forbidden to enter places of entertainment and restaurants and recreation areas and parks.

Under Japanese Control

On the morning of April Fool's day, 1942, the plant was officially, and with much ceremony, taken over by the Japanese. In November, 1942, the Japanese commenced the internment of enemy nationals in condemned go-downs and derelict school premises. The buildings in which we were housed in crowded discomfort were dirty, festooned with cobwebs, overcome with rats and the ubiquitous bedbugs. The camps were run on democratic lines, and the various duties necessary to keep the inmates more or less fit and well were portioned out evenly among the willing and unwilling.

We received some 1,300 calories per day Japanese food ration, largely semi-cooked rice, fat pork, bony fish, and squid, a kind of octopus, mostly head and eyes, with a little potato and some green or root vegetable. Strictly limited quantities of fuel were provided to cook the food, and the Gas Company experts were often engaged chasing the elusive therms. During long periods the delivery, by neutral friends, of food parcels into the camp was prohibited, and we were obliged to draw on the small quantities of food that we had been able to carry in with us to supplement the meagre diet. Fourteen men and a girl escaped from the camps in three groups. A Gas Company man was a member of the last group. After each escape the camp was punished by reduced food and further restrictions on our movements.

Following the third and last escape, one of the inmates was nearly beaten to death by the Japanese during an interrogation, and there were ugly incidents when the camp inmates staged a mass protest and the Japs prepared to open fire. Chinese coolies suspected of smuggling information and money in were brutally treated by the Japanese guards, in full view of the internees.

During the last eight months of the war American fighter and heavy 2- and 4-engine bomber planes straffed and bombed a nearby aerodrome and gun emplacements. When the war ended, flying fortresses dropped food supplies into the camps.

The Chinese Government Takes Over

During our internment we found that the International Settlement had been returned to the Chinese and our extraterritorial rights had been abolished. However, we expected and planned to return to our duties immediately, but under instructions from the Allied Governments the Japanese remained in control until September 18, when, to the beating of drums and the noise of exploding firecrackers, and much flag-waving, the Chinese Government Authorities took the plant over from the Japanese. The ceremony was conducted in Chinese and Japanese, and the British staff were silent witnesses.

Chinese troops installed themselves at the works and demanded supplies of food, cooking facilities, and utensils. We were advised by the Chinese Government representatives that they required the Japanese to remain to operate the plant, and that although the two chief British representatives might return, they would be under instructions from the Japanese. The remainder of our staff were to wait until they were invited to return. These intolerable proposals were ignored.

Actually we had taken over from the Japanese on September 14, and all our men were already more or less securely installed. However, the Chinese employees are in a difficult temper, and there are constant negotiations and threats of strikes. There are elements very ill-disposed to the return of the foreign staff.

The Japanese for a time took full advantage of the situation to exercise what authority was left to them until representations by the British Authorities in Shanghai caused them to be ejected. A number of them were, however, re-employed by the Chinese on the Japanese-built plant operating in the Greater Shanghai area. This plant had been lightly bombed from the air and was temporarily out of commission.

Strained Relations

The Company's finances were still in the control of the Chinese. We were supplying gas at 1/8th of the cost of production, and the revenue from gas sales would not meet labour charges and purchases of essential materials. There were two near strikes when payment of wages to our employees had to be delayed. Relations between the Chinese Government representatives and the workers became very strained, and on November 1 the Company was finally handed over to the British owners.

We were advised that any property damaged or missing must be listed and a claim for reparations made to the Japanese. On the other hand, purchases and additions to our plant made by the Japanese were to revert to the Chinese Government, and we were not to make claims on such properties as reparation for damages.

The plant was found to be undamaged with the exception of a few machine-gun bullet holes in a large steel tar tank. The adjoining Japanese cotton mill is a shambles, a stick of bombs having been dropped along its full length. A detailed inspection of the plant has, however, indicated that the Japanese almost completely neglected plant maintenance and repair during the period they were in control.

Eighteen out of 30 retort auxiliary coal hoppers were corroded to a state of collapse. Bench tie bars were corroded right through and had snapped. One water-gas set was out of commission due to defective blast valves, and the generator steel plate being completely burnt through. Coal conveyors had broken down and been abandoned. Peanut oil was in general use as a lubricant, with disastrous consequences to our cars. Fire-prevention equipment was missing. Lift, coal, crane, and telpher wire ropes were worn out and there were no spares. Routine painting had been neglected and discipline on the works and district considerably relaxed.

The Gangster Element

We further discovered that there were organized gangs removing coal and coke from the works. When our watchman attempted to arrest a group of thieves, and police assistance was called, the thieves counter-charged our watchman for assault and collusion, and our men were actually detained by the police in cells for 3 hours. As a result of this encouragement the gangs now prepare road blocks with clinkers to stop coke trucks, and carry specialized equipment to facilitate the removal of coke from the stationary vehicles. Stocks of our benzole and gasoline and special oils placed at various points on the district by the Japanese for air raid precaution purposes have been removed by various official bodies without our permission, and our efforts to recover them so far have met with little success.

Consumers' meters and high-pressure distribution equipment have been almost completely neglected, and the unaccounted-for gas is 29.8% as compared with our normal figure of 4.5%.

The Japanese at the close of the war obtained two large loans from the Japanese Puppet Nanking Government-controlled Bank. The loans were obtained against a mortgage on our plant. The proceeds were used to pay a Victory bonus to the Chinese employees. They also made large transfers of imported goods from our stores to the stores of the Japanese owned company. The transfers were made at nominal prices representing an average of one- to two-hundred-thousandths of their actual value.

When we took over, the price of gas was fixed at the equivalent of 7d. per 1,000 cu.ft., with coal at £4 8s. per ton and labour at £8 per month, compared with pre-war figures of 3s. 4d. for gas, 17s. 6d. for coal, and £2 for labour. We requested authority to adjust the tariff in order to enable us to pay wages and purchase essential equipment. Although we were not compelled to take additional employees

discussions on the tariff adjustment were procrastinated until we had engaged the four additional men, recommended as apprentices, by the Authorities.

Current Difficulties

The plant is operating on limited coal supplies, and our tar and coke sales are under Government control. Although our former consumers are restricted to 30% normal usage, the Chinese military and police and other officials insist that they should receive unlimited quantities of gas without penalty. In one instance, when our men attempted to disconnect the supply, they were surrounded by armed troops and advised that they would be detained until the supply was reconnected. This proved to be correct.

Business in Shanghai is at a standstill. The big British and American Banks are only nominally open and are doing no business. Utilities are not permitted to pay dividends, or allow for depreciation in their tariff charges.

In other words the foreign barriers are down and Shanghai is now just another typical Chinese city. Should war again come to Shanghai, the dwellers will no longer be able to view the combat from within the safety of the Foreign Settlement; they will be right in the thick of battle themselves.

Modern Homes

The "Modern Homes" Exhibition organized by the *Daily Herald*, which opened at Dorland Hall on March 26, provides a very cheering answer to the question, "What is to be the post-war design for living?"

In the Hall of Houses, on the ground floor, are six fully furnished revolving model houses of types chosen in two of the country's municipal building schemes. All of them, whether "pre-fab." or brick built, show clearly that the need for speedy construction has not stood in the way of careful planning. A point which will appeal especially to the housewife is the meticulous attention that has been given to the kitchen and also to the heating arrangements. A diorama showing the houses in a normal setting enables visitors to see exactly how each house will appear after it is built, and makes it easier for them to choose which type they prefer.

Three kitchens are shown in this exhibition, each room designed for a different type of family, but all incorporating ideas that may easily be used either in adapting old kitchens or in designing new ones. All three are excellent examples of what can be achieved with good equipment and sensible planning. The special feature in the small kitchen planned by the Women's Advisory Committee on Solid Fuel is the multi-duty, two-way appliance which supplies the heating, cooking and hot water services of the house from one solid fuel fire. The kitchen sponsored by the Electrical Development Association has been divided into two working areas—one for cooking, &c., and the smaller for odd jobs, such as ironing, or sewing.

The next room is sponsored by the Women's Gas Council, and is designed for the mother of a young family who wants to keep an eye on her children without having them under her feet all the time. This kitchen is divided into three areas; all of which are warmed by a coke hot-water boiler. The dining portion contains a desk for the mother, and is separated from the actual working area by a projecting double-sided cupboard with an open hatch. The children's small nursery is divided from the working area by a sliding metal gate. Interesting features of this kitchen are the fitment containing a refrigerator and hot-meal cabinet and the instantaneous water-boiling sink heater, which has a three-way thermostatic control, giving warm, hot or boiling water at the turn of a lever. Another feature of the Exhibition is the "Quiz" kitchen, which will give invaluable assistance either in planning alterations to an existing house or in buying or renting a new one.

A surprising new use for aluminium is shown in the Basildon New Period bedroom suite, which has an exterior of impressed aluminium and is finished with a translucent tinted plastic. The interiors have a special finish, which is deadly to moths and insects.

Other exhibits show the new china, glass and pottery; fresh uses for plastics, new utility furniture designs; and after so many years of black-out curtains it is very heartening to see the colourful new furnishing fabrics. Housewives who see the exhibition will no doubt be agog for news of how soon these articles may be obtained. Most of them, we fear, will have to wait a while. Nevertheless, it is good to have something to look forward to, and there is no doubt that this exhibition does much to suggest and encourage improvements in the modern home.

George Wilson Gas Meters, Ltd., have moved their Manchester premises to a more commodious building at 32/34, Cannel Street, Ancoats, Manchester, 4. The telephone number, Collyhurst 2570, and the telegraphic address, Gasmeter Manchester, remain as before. It is hoped that the new works with the greatly improved facilities will enable the firm substantially to improve their service in the North of England.

Some Neck

Twenty of the Gas Light and Coke Company's workshops and depots produced 3,581,100 pieces of war equipment during the war years. Describing how "We ended War Bottleneck" in the March issue of the *Co-Partners' Magazine*, F. J. Walter records that early in 1942 one of the Company's largest industrial consumers, the Non-Ferrous Die Casting Co., announced that shortage of labour was causing serious bottlenecks in their production of war work, and they were unable to supply at schedule rate finished castings urgently required for Air Ministry, Admiralty and War Office contracts. It was agreed to assist by carrying out some of their war work at the Gas Company's Divisional depots. A call for volunteers among workers brought a ready response.

The equipment required to set up the workshops was not easily obtained, but with the help of countless people who were interested to make the scheme a success, work was commenced in record time.

The keenness shown by the Company's men—most of them installation and maintenance fitters—so impressed the Non-Ferrous Company operatives that they came to the workshops in their own time, and gave instructions in the method of fettling castings which ranged from trimming runners to precision filing to fine limits.

These castings were so urgently needed that non-essential work was stopped in workshops at the Divisional depots, with the result that in a few weeks they had removed the bottleneck in the production of the non-ferrous die castings.

Output increased as workers became more competent, and the Company was asked by other large engineering firms to assist them in a similar manner. More varied work was introduced, which necessitated plant being laid down; grinding, drilling, threading, and cutting machines were installed. Everybody who had time to spare gave a helping hand. Many stayed after office hours and worked in the shops, while others took work home when it was possible, and returned it in the morning duly completed. Altogether the volunteers who worked after normal hours completed a total of 111,971 castings at a time when the supply was vital to the war effort.

Shift workers from the distribution C.D. gangs took over the shops in the evening from the day workers so as to maintain and complete the steady flow of work which came in daily. Some jobs required a higher degree of skill and accuracy than others—as in the case of assembling rear gun turret doors for Wellington bombers. An A.I.D. Inspector was continually in the workshop testing every operation.

When the Express Dairy Company appealed for help in assembling milk crates, the Gas Company did not regard this as war work until it was pointed out that the lack of them in some districts was threatening the milk supply. The Company therefore decided to take on this work and eventually produced thousands of these metal crates. The paint shop in the Stove and Meter Department carried out a great deal of work of high quality finish.

War work on the Western Division employed some 20 men at Heston. The most important work was the processing and plugging of cylinder heads for the Napier Sabre engine, in addition to 22 other Sabre parts.

The paint spray shop was kept working at full pressure on a great variety of work. Neon lighting reflectors required a high-grade white surface for maximum reflection. Lath-like strips were painted for the construction of shelter bunks, and some ingenuity was required in the assembly of a special carrier for the suspension of the strips. This was easily the most tedious job undertaken. Wireless tubes had to be treated with anti-gas paint. This was a difficult job, as a hard surface was necessary at the bottom of the 5-ft. diameter tubes.

War work was wound up at Heston by cleaning and repainting 100,000 four-gallon Jerricans which were received and dispatched to various Thames and Bristol depots by Army Transport. A number of these cans appeared to have travelled from North Africa, and, thanks to the Company's paint application, participated in the drive to Berlin. The original contract of 150,000 cans was cut owing to the speed of the European advance.

Two years ago, on the Central Division, a proposal was put to mains gangs on Civil Defence shift duties that they might like to help the war effort still further by undertaking some form of war work during their night duty period when not required for Company's work. Work was obtained which consisted of trimming rough castings by filing, thus forming a smooth foundation for machining, painting, chromium-plating, &c. Workshops were opened at Goswell Road, Rathbone Street, Edgware Road, Kensington, Walham Green, Battersea and Westminster, the workers themselves making and fixing the benches.

The immediate result of undertaking this work was to release younger men in factories to the Services or to more highly-skilled engineering work, but in doing this the Company's men were put on their mettle to keep production up to the same standard set by experienced men.

From May, 1943, to April, 1945, 708,191 castings were trimmed ("fettling" is the engineering term), and during the peak period, 60,000 were handled in one week.

Removal of Sulphur Compounds from Town Gas by Catalytic Hydrogenation

By E. B. MAXTED, D.Sc., and J. J. PRIESTLEY, M.Sc. (W. C. Holmes & Co., Ltd.)

(*Concluded from p. 557*)

The first of these is a self-contained unit capable of handling up to 250 cu.ft. of gas per hour. The second shows a typical self-contained plant capable of handling up to 10,000 cu.ft. of gas per hour.

The 250 cu.ft. per hour unit consists of a small converter which stands upon a purifier. In the converter the tubular heat exchanger is omitted, but by an arrangement of concentric shells a considerable degree of heat economy is achieved. The catalyst is situated in an annular basket similar in shape to that in the Mirfield plant. Catalyst can be charged at a plug on the top and discharged from a corresponding plug at the bottom. The converter is heated by a ring burner situated around the lower portion, the flue gases travelling first in an upward direction and then being suitably baffled to impart a maximum of heat to the incoming gas. The gas to the heating burner is thermostatically controlled by a Sperryn thermostat.

The 1,000 to 10,000 cu.ft. of gas per hour unit consists of four main units, which are: the gas booster, the converter, the gas cooler, and finally the oxide purifiers. On this larger type of converter the tube heat exchanger is incorporated, but is situated above instead of below the catalyst basket. Again the annular form of basket is used. As with the 250 cu.ft. per hour unit an ordinary atmospheric type ring burner is used for heating, the gas being thermostatically controlled as before.

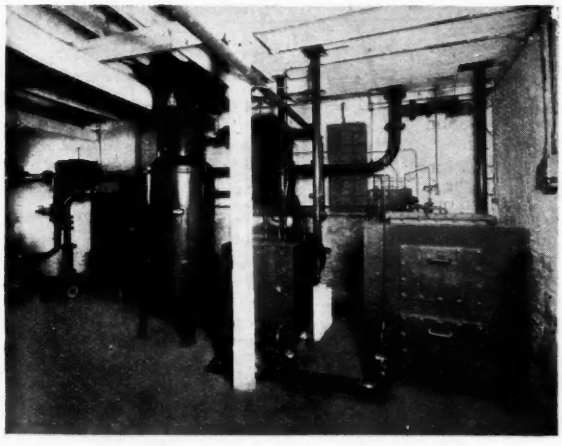

FIG. 17.—*Industrial CSR plant, capacity* 4,000 *cu.ft. per hour, installed at a Stourbridge glass-works.*

An arrangement of working the purifiers is adopted as follows (Patent Application No. 13258/45): one purifier is put to work in the normal position after the gas cooler, the other one being placed on the gas stream before it enters the converter. In this way, use is made of the oxygen content of the incoming gas to effect a revivification *in situ*.

After operating thus for, say, one week, the position of the two purifiers is interchanged by the operation of one lever moving two four-way cocks, thereby allowing the revived purifier to go to work, and the other purifier to be revivified. Excellent results have been obtained with this arrangement.

The operation of the plant is extremely simple, since the oxygen variations on a gas-works are here absent. No elaborate measures need to be taken for preventing overheating of the catalyst. A simple thermostat is quite adequate.

Catalyst charging and discharging is done intermittently as required, and is a matter of minutes only.

The plants are usually arranged so that they require no adjustment with changing of gas throughput. When the gas load is taken off, as for instance at night, the thermostat comes into action and shuts down the heating burner, thereby keeping the converters warm through the night. Detailed experiences of operating this type of converter are given by Mr. Tomes' Paper, to which reference should be made.

Data on sulphur removal have been collected from various plants in this country and set down in Table IV. It will be seen that on the whole the percentage removal of sulphur compounds is greater than that obtained at Mirfield. The varying degree of removal among the figures themselves is due mainly to differences in the types of gas supplied to the plant.

TABLE IV.—SULPHUR REMOVAL ON INDUSTRIAL CSR PLANTS ON TOWNS GAS IN VARIOUS LOCALITIES AND ON PRODUCER GAS.

Locality.	Type of gas.	Works.	Sulphur compounds. Inlet plt. grains/100 cu.ft.	Sulphur compounds. Outlet plt. grains/100 cu.ft.	% Sulphur removal.
A	V, WG, COG	Pottery	18.5	1.7	92.0
B	H, WG	Glass-works	32.5	6.2	80.9
C	V, WG	,,	27.5	2.8	89.2
D	V, WG	Metallurgical	23.1	3.1	89.2
E	V	Glass-works	4.0	0.9	77.5
F	H	Experimental	32.9	4.9	85.1
...	Purified producer gas	Glass-works	15.8	3.4	78.5
...	Crude producer gas	,,	29.0	10.0	65.5

V = Vertical retort gas. WG = Water gas.
H = Horizontal retort gas. COG = Coke oven gas.

Cost of Process.

As would be expected with smaller scale, the actual cost of sulphur removal is higher than that at the gas-works. It has been agreed, however, by users that the cost as it stands is negligible compared with the saving due to a higher quality of the processed article. A great deal depends on how long the plant is run during, say, one week—that is, whether it is run through the night, or whether it is only shut down at weekends.

Note that intermittent use of the plant means that either gas has to be used to keep the plant warm; alternatively it has to be expended in warming up the plant from cold. In his paper Mr. Tomes gives the following figures, which can be taken as approximately representative of the plants so far installed. Costs are given of a plant working for (*a*) a 90-hour, and (*b*) a 168-hour week. The costs, &c., work out as follows:

COST PER THERM (J. A. TOMES).

	90-hour week.	168-hour week.
Operating costs	0.242	0.197
Capital charges	0.296	0.159
Total cost/therm	0.538	0.356

Nine Showroom Windows of the Sheffield and District Gas Company are, in collaboration with the Ministry of Agriculture, to be devoted to the publicizing of the "Lend a hand on the land" campaign. Posters and showcards will be on display, and literature dealing with Agricultural Camps will be distributed. Sulphate of ammonia will be shown in connexion with these displays, and leaflets supplied by the Ministry of Agriculture dealing with the importance of sulphate of ammonia as a fertilizer in the production of more food will be available.

Gas Consumption at Bedworth has increased 400% since the original gas undertaking was taken over by the Coventry Corporation, and the need for showrooms for the service of the Bedworth and district consumers has long been recognized as of prior importance by the Coventry Gas Department. It has therefore been decided to open showrooms in the near future. The proposed site is at the corner of King Street, Bedworth, and should be available very shortly. The showrooms will be available for normal transaction of business together with the registering of complaints and the taking of accounts.

Five Members of the Staff of the Peterborough Gas Company were last week presented with Savings Certificates contributed by their colleagues. They were Mr. D. J. O. Bath, who, after four years as Assistant Engineer, is leaving to take up an appointment as Deputy Engineer and Manager to the Bilston Gas Light and Coke Company; Miss J. B. Bloodworth, who after six years' service is entering the nursing profession; Mr. R. N. Gray, gas fitter, on the occasion of his marriage; Mr. C. F. Phillips, foreman gas fitter, and Mr. J. W. Reedman, gas fitter, who have been 45 and 38 years respectively in the service and are now retiring.

Domestic Gas Cookers—Design of the Hotplate*

By E. W. DUNNING, B.Sc.Lond., A.R.I.C.

(Watson House, Gas Light and Coke Company)

THE gas consumption of the hotplate of the 8–9 million gas cookers installed in this country accounts for nearly 40% of all the gas sold. An analysis of the amount of gas used on the cooker for the different purposes showed that out of a total of 80 therms per annum, 56 therms are used on the hotplate; of this, 10 therms are used on the griller, half for toasting and half for grilling; 4 therms for frying; 32 therms for cooking on the hotplate—boiling, simmering, &c.; and 10 therms for kettle boiling. The latter may increase to 30 therms if a constant hot-water supply is not available.

Boiling Burner Requirements

There are three principal requirements for the boiling burners on a hotplate. The first is for rapid and efficient heating of liquids. Boiling water is required for tea-making and many cooking processes—*e.g.*, cooking vegetables and boiling eggs. Hot water is largely obtained on the hotplate for washing-up, ablutions, laundry and home cleaning owing to the general absence of a real hot water service in most houses to-day, although the use of the hotplate for this purpose will gradually diminish. In addition to water heating, the boiling burners are used for heating other liquids such as milk, soup, &c., and at lower gas rates for continuous boiling of vegetables, and steaming puddings. The second requirement is for simmering—the maintenance of nearly boiling conditions over long periods. A temperature of about 190°F. is required (175°F. is too cold and 205°F. is too hot). Potentially, gas has a great advantage over all other fuels owing to the variation of heat possible with the gas tap. Lastly there is frying, either dry frying (bacon, sausages), shallow frying (liver and steak), or deep frying (fried fish, chips, fritters), &c.

There are other auxiliary uses of the boiling burner, such as toast making, laundry iron heating, curling and soldering iron heating, as well as heating the kitchen.

Taking a cylindrical vessel 7½ in. diameter by 5 in. high, with polished sides and blackened bottom, fig. 1 shows the variation of efficiency with gas rate when the sides and base are polished or

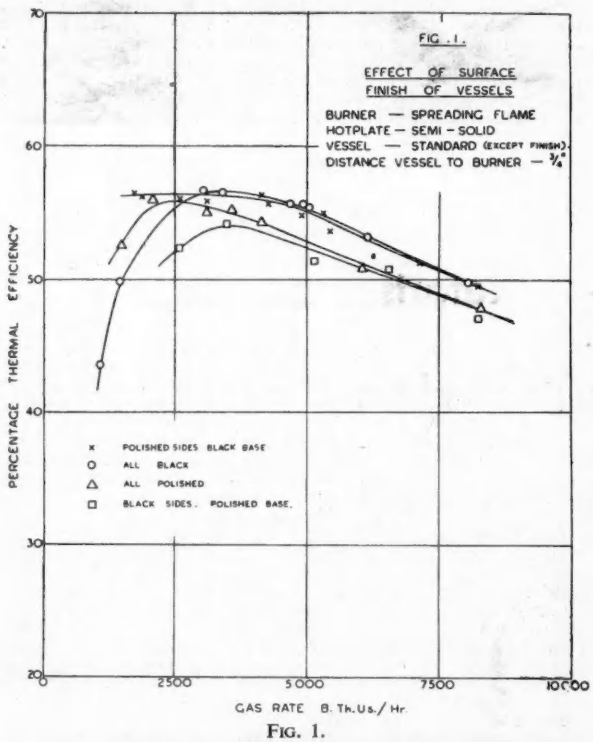
FIG. 1.
EFFECT OF SURFACE FINISH OF VESSELS
BURNER — SPREADING FLAME
HOTPLATE — SEMI-SOLID
VESSEL — STANDARD (EXCEPT FINISH)
DISTANCE VESSEL TO BURNER — ¾"
PERCENTAGE THERMAL EFFICIENCY
GAS RATE B.Th.Us./Hr.
× POLISHED SIDES BLACK BASE
○ ALL BLACK
△ ALL POLISHED
□ BLACK SIDES. POLISHED BASE.

FIG. 1.

blackened. Above a gas rate of 3,000 B.Th.U./hr. the finish of the base is of more importance than the sides, a black base increasing the efficiency by 2–3 units as compared with a polished base. At low gas rates the heat losses from the sides becomes of greater importance and the efficiencies are in the expected order: polished sides—black base; polished sides—polished base; black sides—black base; black sides—polished base.

Fig. 2 shows the effect of variation in size of vessel, the latter being of the general design of the standard vessel. The efficiency at first varies very rapidly with increase in diameter of vessel (approximately proportional to the area of base), but the rate of increase falls off rapidly, and there is surprisingly little increase in efficiency from a 9-in. to 20-in. vessel (5 units in efficiency). As the vessel gets larger there must be an effect similar to that of decrease in gas rate with constant size of vessel when the heat losses from the vessel gradually approach the heat input to the base.

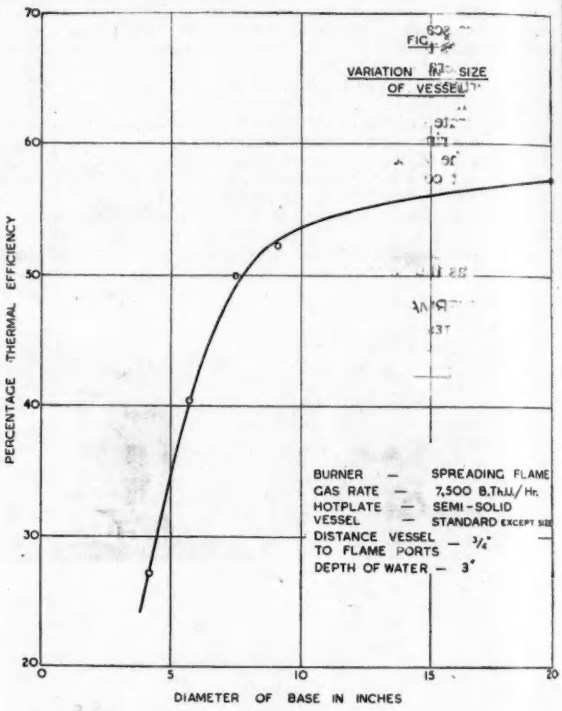
VARIATION IN SIZE OF VESSEL
PERCENTAGE THERMAL EFFICIENCY
DIAMETER OF BASE IN INCHES
BURNER — SPREADING FLAME
GAS RATE — 7,500 B.Th.U./Hr.
HOTPLATE — SEMI-SOLID
VESSEL — STANDARD EXCEPT SIZE
DISTANCE VESSEL TO FLAME PORTS — ¾"
DEPTH OF WATER — 3"

FIG. 2.

While the standard vessel is useful for comparing different burners, the housewife uses a great variety of utensils on the hotplate. Some of these utensils have been compared with the standard vessel, so that the efficiency obtainable on any burner can be predicted knowing the efficiency with the standard vessel.

In the gross efficiency the water equivalent of the vessel has been included in the water heated as with the standard vessel. The net efficiency is more practical, being based only on the actual water heated. A range of enamelled saucepans has been compared on two different hotplates, and although the comparison figures are not identical, they are sufficiently near for practical purposes. The large vessels (bath, pail, wash boiler, &c.) are not very much more efficient than the standard vessel on the gross figure, but the net figure is almost as high, as the water equivalent is only a small proportion of the total water heated. The thermal capacity of aluminium ware is much higher than that of enamelled ware, being as great as that of cast iron; this reduces the net efficiency. A lid on a saucepan increases the efficiency by about 5%. Square vessels have a similar efficiency to round vessels of the same base area, but two placed together give double the efficiency of two round vessels similarly placed.

The finning of the base of kettles increases the efficiency and speed by 30%. Thus assuming the kettle is boiled six times a day, the cost of the kettle may be saved in a year. It might be argued that all cooking vessels should be finned in the same manner. The chief reason against this is that most vessels have to be washed up after use, and this is difficult with fins on the base. Also, the extra cost of finning would take a long time to recover in decreased gas consumption as each individual utensil is used less frequently than the kettle. Fig. 3 shows the base of the finned kettle. The original simple design was found to sit down on some hotplates and smother the flames. The curved design was therefore developed to obviate this.

* From a Paper to the London and Southern District Junior Gas Association, March 8.

FIG. 9.

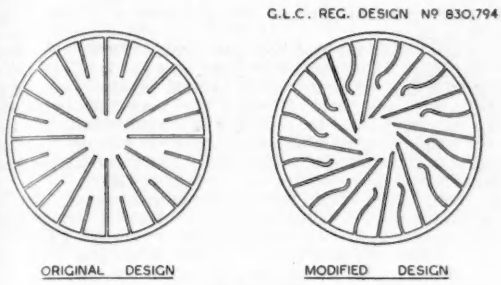

FIG. 3.

Even severe scale ¼ in. thick built up during 10 years' continuous use only reduces the efficiency by 5%, as would be expected from heat transfer considerations.

It is unfortunate that many housewives find it necessary to use the hotplate for heating water in baths, pails, and wash boilers, as they have no separate hot water supply, or even a gas-heated wash boiler. Sagging of the rim of a large bath may occur if the hotplate bar does not support the vessel at its edge, and this may reduce the flue gas exit and affect combustion. Pails with an edge rim may also override the normal vessel support and cause incomplete combustion unless secondary relief outlets are provided.

Fig. 4 shows the thermal efficiencies of over 200 production burners tested at their maximum gas rates. In general there is a steady rise in efficiency as the gas rate is decreased. There is, however, a wide

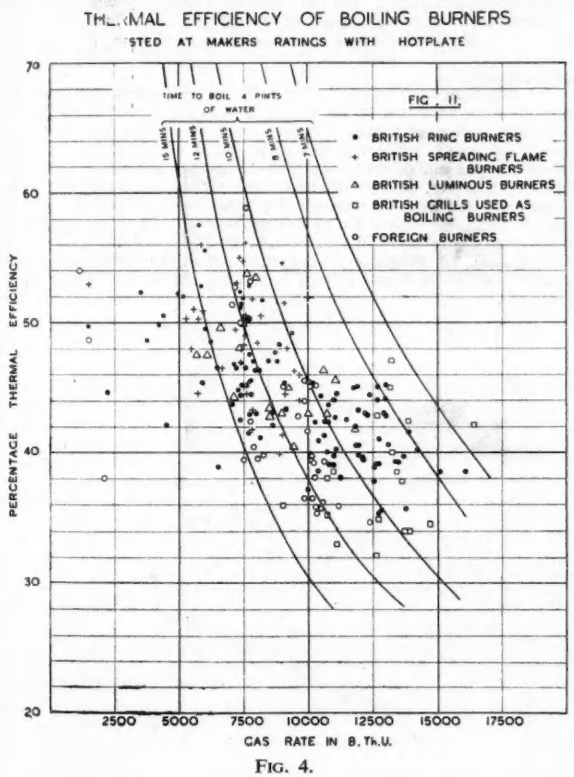

FIG. 4.

band of efficiencies at any one gas rate. The efficiencies of spreading flame burners tend to be higher than drilled ring burners, although the former are not rated at higher gas rates than 10,000 B.Th.U. per hour. The maximum gas rate used is about 15,000 B.Th.U. per hour, similar to A.G.A. A number of foreign burners (American, French, Belgian, German) have been examined from time to time. Although most foreign burners have lower efficiencies than British burners, some have high efficiencies, although only at low gas rates (7,500 B.Th.U. per hour). Grills used as boiling burners have low efficiencies, although this is partly due to their high gas rates.

Types of Burner.—There are three main types of aerated burner—the spreading flame, ring, and Méker—although there is no clear-cut division, one type gradually merging into another. The spreading flame type has its flame ports horizontal or nearly so, and as the flames become more nearly vertical the drilled ring is reached. The Méker burner generally has vertical flame ports. An entirely different type is the luminous burner made up of a number of steatite jets so designed that while there is no primary aeration there is considerable auto-aeration.

The vertical flame burner should give the maximum heat transfer at any given aeration and distance from the vessel. This is due to the vertical flame giving the maximum change in direction and being very compact, and the maximum travel of the hot gases. The aeration of the vertical flame is, however, more influenced by the proximity of the vessel, and satisfactory combustion is more difficult to achieve.

A large number of small burner ports give a similar thermal efficiency to a small number of large ports at the same distance. It is, however, possible to bring the burner nearer to the vessel with small ports, although these can more easily become clogged. A spreading flame is the most proof against spillage when used with open hotplate bars, while the luminous burner and the vertical Méker types can only be used satisfactorily with some form of protection, such as a solid plate—although this need only be small.

Fig. 5 shows the effect of variation in air-gas ratio at different gas rates. The form of curves at different aerations is similar for any one type of burner, and all burners appear to give a maximum efficiency with an aeration of 2 : 1. With the ring burner at low gas rates the low aeration is more efficient as the longer flames give better flame contact. On turning down the gas to a normal burner by the tap the aeration decreases, giving increased flame stability. It has recently been shown that at simmering rates ($\frac{1}{10}$th normal) the aeration normally rises again and thus gives reduced stability at very low rates.

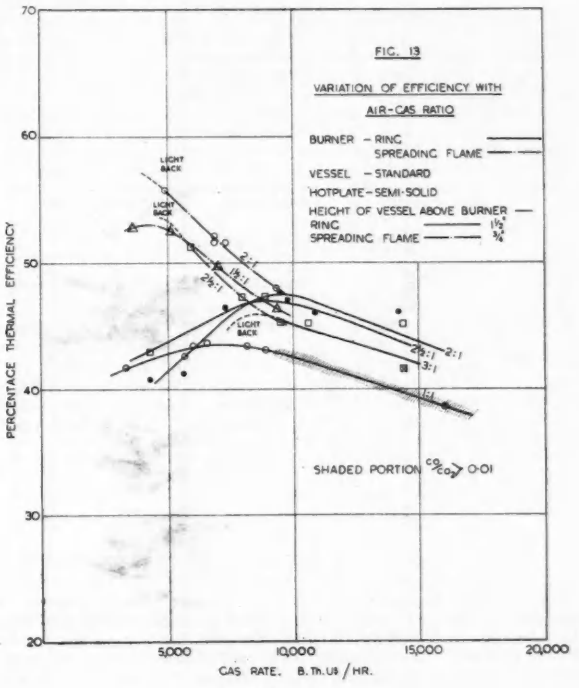

FIG. 5.

The combustion efficiency falls rapidly as the aeration falls. The improved combustion at high aeration allows the burner to be placed nearer to the vessel with improved thermal efficiency. It should be noted, however, that as the burner is brought nearer to the vessel the aeration decreases due to the baffling effect of the base of the vessel on the burner ports.

A fixed gas rate (by fixed orifice and governor) and fixed air ports allow the burner to be set at optimum conditions without fear of interference by the housewife or fitter. When a governor is fitted it is only necessary that the appliance withstands a 50% pressure overload and the burner can be brought nearer to the vessel with consequent increased thermal efficiency. Some change in aeration will result due to changes in gas quality; tests have, however, shown that the effect on thermal efficiency is small. Variations in gas quality also affect the combustion of a boiling burner; on the one extreme a low A.T.B. gas results in lighting back, while at the other extreme a high A.T.B gas results in low aeration and poor combustion.

The minimum secondary air flow should be aimed at which is consistent with satisfactory combustion under overload conditions. The secondary air can be restricted by a bowl surrounding the burner. This restricted air inlet should be arranged so that all the air is directed round the flames, thus improving the combustion, and so allowing the

burner to be placed nearer to the vessel with a consequent further increase in efficiency. A polished bowl also reflects radiant heat, and the effect is greatest with solid hotplates owing to the high temperature of the fins or pips compared with the water-cooled vessel on an open hotplate.

We have found that a blackened bowl increases the thermal efficiency by about 2 units, while a polished bowl increased the efficiency by a further 2 units when used with a solid hotplate. These confirm the A.G.A. figure of 3% increase. The higher efficiency obtained is, however, offset by the difficulty of cleaning, since the bowl gets hot and is well placed to receive any spillage from the vessel.

All ring burners and some others have a central hole to allow secondary air to reach the inside of the flames. This improves combustion, and in some cases allows the burner to be placed nearer to the vessel, with consequent improved thermal efficiency. As the secondary air hole increases, the flames must be on a bigger diameter and so have less travel over the base of the vessel; with the Méker burner a lower efficiency was obtained with even a small central hole.

Fig. 6 shows the thermal efficiency (Ep) and the calculated heat transfer efficiency (E) for the same burners. It will be seen that although the thermal efficiency falls off sharply at low gas rates, the

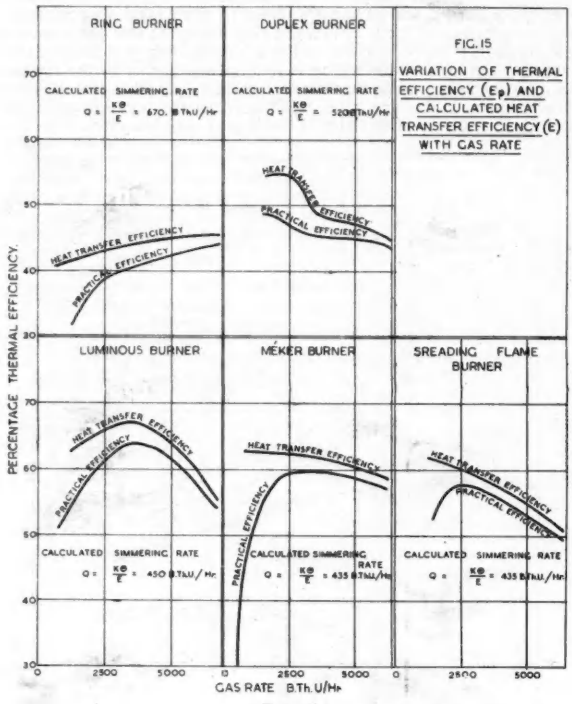

FIG. 6.

efficiency of heat transfer continues to increase. As the gas rate is reduced the flames decrease in size, and with the luminous and ring burners they recede from the vessel; the heat transfer efficiency thus finally falls off. The spreading-flame and Méker burners, however, do not give a decrease in heat transfer efficiency, as the flames do not recede from the vessel on turning the gas down. When the temperature reaches equilibrium just below the boiling point of the liquid (190°F.) simmering is achieved. Under these conditions the heat input to the vessel is just balanced by the heat losses as the temperature of the liquid remains constant and the thermal efficiency is zero. A high heat transfer efficiency at low gas rates means a lower gas rate for simmering, and thus a greater tendency for the burner flames to be blown out by draughts. A cast-iron simmering plate or an asbestos mat achieve their effect mostly by the reduction in heat transfer, and thus allow higher and more stable gas rates to be used.

It is necessary to reduce the gas rate to about 500 B.Th.U. per hour for simmering. Leaving the lid off the vessel allows a higher rate to be used, but there is more sticking to the bottom of the vessel. The luminous burner is the most satisfactory, followed by the duplex burner. The vertical flame burner even with a protecting disc is the least satisfactory. Both the simmering plate and asbestos may allow a higher and more stable gas rate to be used, but the former is more satisfactory.

Design of Vessel Support

(a) *Design of hotplate section.*—The hotplate bars or sections are designed primarily to support the vessel above the burner at the optimum height. The control of secondary aeration mentioned earlier may also be embodied in the hotplate section itself.

In an effort to obtain bars which can be easily cleaned, straight bars have been tried with a burner firing between them. The efficiency was normal at a low rate of 6,000 B.Th.U. per hour, but fell off so rapidly with increased gas rate that the speed of heating hardly increased at all.

Four main conditions have been considered. Firstly, with no hotplate—the vessel being supported from above. Secondly, an open hotplate with just sufficient support to hold vessels of various sizes. Thirdly, a semi-solid hotplate which may consist of the filling in between the open bars or the provision of a bowl beneath the burner. Fourthly, a solid hotplate which may have ribs or pips on its underside to improve the heat transfer. The open hotplate with its low thermal capacity gives a quick response to gas rate variations. The flames are also more easily visible for adjustment of the heat. The solid hotplate on the other hand gives better pan stability, and presents a more easily cleaned surface. All tests are carried out starting with cold bars. This is the most usual condition in practice. The A.G.A. have shown that a 5% increase in efficiency is obtained if a second vessel is heated after the first is removed. The difference will be more marked as the thermal capacity of the hotplate increases.

A semi-solid hotplate reduces the efficiency by about 4 units as compared with an open hotplate. Even an open hotplate reduces the efficiency by 6–7 units (about 10%) as compared with a suspended vessel. Forshaw found a similar result. The solid hotplate used in these experiments was described in 1940, and was developed as a result of tests with 18 different designs. It will be seen that with flat vessels it is possible to obtain cold-start efficiencies comparable with those obtained with open hotplates. Reference has already been made in the section on vessels to the effect of the degree of flatness of the vessel, and developments have been made towards obtaining equally good results with ordinary slightly dented vessels. Two lines of approach are being studied. On the one hand the development of a corrugated light metal plate similar to the semi-radiant electric hotplate, giving results which are more or less independent of the flatness of the vessel. A satisfactory semi-radiant plate has not at present been developed. On the other hand solid hotplates of smaller diameter than the normal vessel have been produced; with these heat transfer is obtained beyond the plate by normal convection on the annular ring of the vessel not covered by the plate and up the sides of the vessel.

(b) *Height of vessel above burner ports.*—Fig. 7 shows that generally the efficiency increases as the burner is brought nearer to the vessel. The efficiency of the Méker burner changes surprisingly little with height of vessel, while the spreading flame and luminous burners show a rapid fall of efficiency with increasing distance. The combustion, however, deteriorates as the burner is brought nearer to the vessel, and this leads to a progressive reduction in efficiency. This is seen particularly with the ring burner, where there is a pronounced peak in efficiency at 1½ in. (*cf.* A.G.A. 1¼–1½ in. optimum for 12,000 B.Th.U./hr). A reduction in height, while still retaining satisfactory combustion, is the surest way of improving the thermal efficiency of a burner.

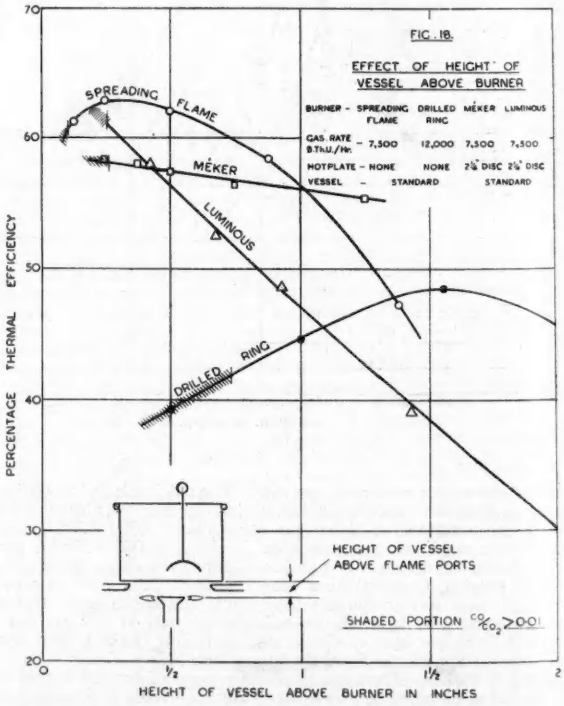
FIG. 18.
EFFECT OF HEIGHT OF VESSEL ABOVE BURNER
BURNER – SPREADING FLAME | DRILLED RING | MÉKER | LUMINOUS
GAS RATE B.Th.U./Hr. – 7,500 | 12,000 | 7,500 | 7,500
HOTPLATE – NONE | NONE | 2¾" DISC | 2¾" DISC
VESSEL – STANDARD | | | STANDARD
SPREADING FLAME
MÉKER
LUMINOUS
DRILLED RING
PERCENTAGE THERMAL EFFICIENCY
HEIGHT OF VESSEL ABOVE FLAME PORTS
SHADED PORTION $\%CO_2 > 0.01$
HEIGHT OF VESSEL ABOVE BURNER IN INCHES

FIG. 7.

Practical Efficiency

The two most important factors in saving fuel on the hotplate have nothing to do with the design of the hotplate itself. They are wastage of gas left burning and the heating of more water than is actually required. The gas may be left full on during the filling of the kettle and making the tea. Even one minute's delay in turning off the gas would reduce the efficiency from 50% to 43%. The gas is often turned down and left burning under the kettle to keep the water hot during tea. Even at 4 cu.ft. per hour the efficiency may be reduced from 50% to 29% by leaving this amount of gas burning during half-an-hour's tea-time. We come to the effect of heating more water than is required. If 2½ pints are required for tea making, the efficiency is reduced from 50% to 30% if 4 pints are heated instead. If 1 pint of water is sufficient for cooking a vegetable, the efficiency is reduced from 40% to 10% by using 4 pints of water.

GRILLERS

Requirements

The first requirement of a griller is the efficient preparation of toast. This requires even toasting at a sufficient speed to brown the bread before the toast becomes too dry and rusk-like. Such a griller will also brown or "salamander" the tops of dishes such as cauliflower *au gratin* or welsh rarebit, providing there is sufficient room under the grill, but it is doubtful whether any domestic grill is sufficiently fierce to cook "minute" steaks. Secondly, the evenness of grilling should be maintained at lower gas rates (say, down to half gas rate) so that food requiring a longer cooking time, such as chops, fish, dry toast, &c., can be cooked through while remaining evenly browned outside. Some adjustment of the position of food under the grill is necessary. The thickness of food varies from the thinnest bacon to the thickest steak (1½ in.), and the position of the surface of the food must be adjusted for temperature. Small pieces of food, such as kidney, tomato, small sausages or thin bacon should not fall off the grid; the fat which runs out of the food should be protected from overheating, this being the great advantage of grilling over frying. The grill pan should be easily located in the correct position.

A further requirement may be the use of the grill for water boiling. This may be necessary owing to the restricted space available on the hotplate.

Design of Burner

Position of burner ports.—Most burners consist of a single bar or "poker" burner with burner ports on either side, or a double burner with the ports in each section facing each other. The poker burner is the simplest and cheapest, but cannot be made to cover such a wide area as the double burner. In both cases there should be more gas burnt at the ends than in the centre. This can be achieved by grouping the burner ports closer together at the ends, but care is necessary to ensure that the ports light across the centre of the grill. Alternatively the burner ports can be equally spaced, but of larger diameter at the ends; lighting across is easier, but the smaller ports at the centre are more easily blocked.

There is a wide divergence in grill efficiencies—some being 2½ times as efficient as others. 40% tested had 10–15% radiant efficiency (mostly old designs), 45% were 15–20%, while 15% had efficiencies of 20–25%. Forshaw has given 25% as the radiant efficiency of the best pre-war grills. A cover over the grill in general leads to a higher efficiency; three-quarters of the grills in the range 20–25% efficiency had covers. Double burner grills, although less usual than poker grills, did not seem to differ in efficiency.

Secondary aeration—covers.—The main effect of a cover over the grill frets is to control the flow of excess air and so prevent the hot gases being diluted. It also acts as a reflector, and reflects back some of the radiant heat from the top of the grill fret. It also prevents dirt falling on the frets and stops splashing from the grilling process.

As the skirt of the cover is deepened an increase in efficiency and improvement in cooking quality result. A maximum is reached when the grill pan touches the cover, and the grill is completely enclosed except a space left for viewing the food at the front. The grill cover can then either be provided with runners so that the grill pan can be adjusted for height; or alternatively, the skirt can be attached to the grill pan itself. This allows more room for stacking plates and vegetable dishes on the crown tray, but the pan is a little clumsy and more difficult to clean.

Regarding the effect of variation in size of flue opening on radiant efficiency with both black and polished covers with skirts, the radiant efficiency increases as the opening is reduced and the polished cover results in a higher efficiency—this, however, approaches that of the black cover as the size of opening is increased. A black cover can increase the radiant efficiency by 6 units in efficiency (30–40%), while a polished reflector increases the radiant efficiency by 12 units (75%). Lagging the outside of the grill cover with aluminium foil increases the radiant efficiency still more. With the polished cover lagged with six layers of aluminium foil a radiant efficiency of 35% can be obtained. Reduction in depth of skirt progressively reduces the radiant efficiency from 16% to 12%.

There is little change in efficiency in the range normal to half normal heat input, the peak occurring at about three-quarters normal. Toasting tests, however, show that the quality of toast falls off as the heat input is reduced and the time of toasting increases.

Design of Grill Fret

Type of fret.—With the single bar burner the maximum radiation from the fret must be obtained from the ends furthest from the flames. This can be obtained by increasing the number and length of pips nearer the ends, by sloping the fret, or bending the end downwards. With the double burner grill the maximum radiation is required as near the burner as possible, reducing as the centre of the fret is approached. As the hot gases are progressively cooled they can leave the fret at the centre cooler than is the case with the single burner grill. It should therefore be possible to obtain a higher efficiency from this type of grill.

As the domestic grill is used for short period cooking (5 to 15 minutes), speed of heating is important. This is achieved by a reduction in weight of fret. The light metal frets show a saving of 15% in time and gas compared with cast iron in toasting eight slices. The first load of four slices shows a saving of 30%. Many materials have been tried for the light metal frets, but a 20% chromium steel seems to have the longest life at the temperature of the fret in the products of combustion, being far superior to cast iron and having a life commensurate with that of the cooker.

Height of fret above flame.—The maximum efficiency is obtained when the fret just does not cut the inner cones. The effect of height on combustion is especially critical, and it is advisable to register the grill fret on the burner by supporting lugs. If, in addition, the burner drillings are also jigged from these lugs the minimum distance can be used.

Grill Pan

The variation in the height of food may be effected by adjustment in the height of the grid in the pan or by the pan itself. The latter is to be preferred, and runners on the sides of the grill cover seem the best solution as the food can be varied at will, even during the cooking process, and the pan can be easily cleaned. If the grid is a metal sheet with holes or slots to allow the fat to run through, overheating of the fat and meat juices expressed during the cooking process is avoided. The sheet also improves the efficiency of grilling by reflecting heat back to the grill fret from the parts not covered by food and by conduction of heat to the underside of the food being grilled.

DESIGN OF HOTPLATE

Size and Position of Burners

As the small burners are of special use for simmering or keeping vessels gently boiling they need to be at the back of the hotplate, out of the way. It is also convenient to have the largest burner at the front for kettle boiling and drying. There is, however, a tendency for this burner, being convenient at the front, to be used for many other purposes, such as heating small quantities of milk, for which a higher efficiency would be obtained with one of the smaller burners at the back. There are technical difficulties in having the large burners at the front; the aeration becomes more difficult with short shank burners and the taps tend to get overheated. The burners also need to be well spaced to allow vessels to be placed centrally over each burner.

Combustion Characteristics of the Hotplate

It is essential to consider the combustion of the whole hotplate when more than one burner is in use. The products of combustion from one burner may affect the combustion of another burner, or large vessels, such as baths, may reduce the free space for removal of the products. Tests are carried out with all the burners in full operation but a further margin of safety is obtained, as it is impossible to use the burners like this for a long period, as in actual practice the water boils and the gas rate of the boiling burners is reduced, the toast or grill is prepared and the griller turned out, &c. The effect of vitiated atmosphere on the combustion of boiling burners and grillers must also be considered.

Ease of Cleaning

There is no doubt that improvement is required, and much can be done to this end if the factors affecting ease of cleaning are well understood. In this age of labour-saving devices the advantages of gas must not be offset by the drudgery of cleaning.

One of the more important factors affecting the ease of removal of the dirty deposit is the temperature of the surface. Experiments have been made on the ease of removal of grease from surfaces when the grease had been baked on at different temperatures. While it is difficult to give quantitative results of difficulty of cleaning, it was found that the grease became increasingly difficult to clean as the temperature increased from 390°F. to 520°F., and there was a marked difference in ease of cleaning for even a 50°F. rise in temperature. At higher temperatures than 520°F. the grease tended to burn off and the cleaning became less difficult. It thus seems clear that surfaces should either be kept as cool as possible (below 400°F.), or allowed to become so hot that the grease burns off.

Lastly there is the shape and design of the surfaces. Here common sense plays an important part. The rounding of corners and crevices

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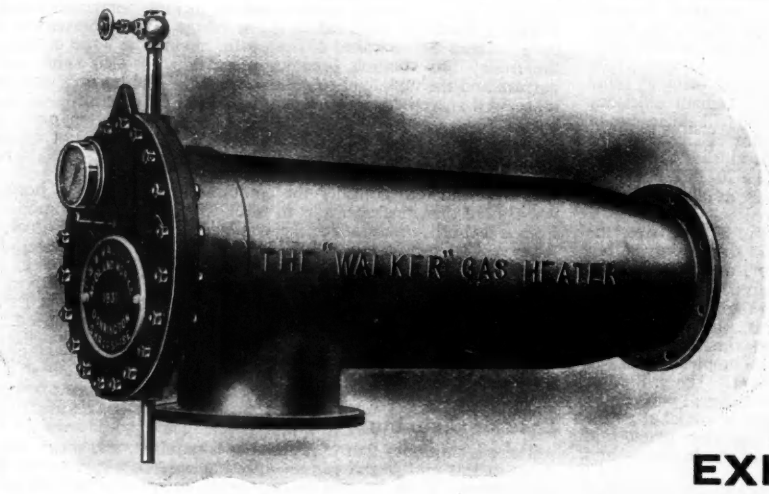

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seems obvious, but it is surprising how badly many parts are designed from this point of view. Pressed steel parts, although often far from ideal, have to be rounded for technical reasons, and thus are generally easier to clean than castings, although there is little reason why the latter should not be much improved. Most castings have raised or recessed lettering as trade-marks and to distinguish the various parts. These have no interest to the consumer, except as grease traps, and when enamelled are not even decipherable. Pressings are technically difficult to mark, and yet there appears to be little difficulty in distinguishing the various parts. Joins must form dirt traps, but they can be more easily cleaned if they do not occur at re-entrant angles (*a*), and dirt lodges less on vertical surfaces (*c*) than on horizontal ones (*b*). It is better still if the join can be obviated (*d*) by designing larger parts, although these are more expensive to replace if damaged.

Maintenance

By this term is meant the maintenance of the complete hotplate in perfect working condition throughout its life, although the actual maintenance required by the housewife, and especially the fitter, should be the absolute minimum. The experience gained in the Gas Light and Coke Company, with nearly three-quarters of a million cookers each with a pressure governor, fixed gas injectors, and fixed secondary air ports, has shown the undoubted advantages of this system in the maintenance of the cooker. There are no adjustments to get out of order or provide projections which make cleaning more difficult. All that is necessary is that the design should be adjusted to give reasonable results over the range of gas quality likely to be experienced.

Durability of Refractory Materials in the Carbonizing Industry

A "GAS JOURNAL" Abstract

A PAPER was given recently by Dr. E. Heaton, Mr. F. H. Clews and Mr. A. T. Green to the North-Western and the North-Eastern Section of the Institute of Fuel on the question of the durability of refractory materials in the carbonizing industry. In the course of their Paper the Authors stated that in the carbonization of about 36 million tons of coal, 120,000 to 150,000 tons of refractory materials are used annually. It is therefore clearly of importance to select refractories which will best meet the conditions of service, and to study the causes which mitigate against their durability. Observations show that refractories are subject to different destructive agencies in different portions of the several types of carbonizing plant. Failure is thus zonal, and characteristic of the zone in which the refractories are used.

The first part of the Paper summarizes relevant data, particularly with reference to slag erosion and the attack of alkali vapours at various temperatures. The second part classifies in general terms failures observed in the three main types of plant, continuous vertical retorts, horizontal retorts, and coke ovens. The same principles apply to intermittent verticals and CWG plant, but these are not specifically dealt with.

PART I.

Silica refractories, defined as containing more than 92% SiO_2, are generally manufactured from crushed ganister or other silica rock with about 2% lime bond. In the kiln the quartz is more or less converted to cristobalite and tridymite. Quartz having a specific gravity of 2.65, cristobalite of 2.31, and tridymite of 2.26, the conversion involves an increase of volume and a decrease in specific gravity, which reduction indicates the degree of conversion. In the finished material a sp. gr. less than 2.35 is desirable. But conversion in the kiln is never complete, and silica goods tend to continue to grow in volume when exposed to continued high temperature.

"The reversible thermal expansion of silica bricks is also characteristic." Reversible expansion, which may be as much as 1%, occurs in the temperature range 200°–300°C. owing to a rapid and reversible transformation of α cristobalite to β cristobalite, while similar inversions, though with much smaller volume changes, occur at about 565°C. (quartz) and between 100° and 200°C. (tridymite). Above 600°C. reversible expansion is very slight. Silica structures therefore give little trouble due to temperature fluctuations around working temperatures, but "the greatest care is needed in first bringing an installation into service . . . when passing through the range 200°–300°C."

Siliceous refractories, defined as containing more than 78 and less than 92% SiO_2, consist of quartz grains in a bond of clay. Some transformation of quartz to cristobalite occurs in the kiln, but the change is more sluggish than with lime-bonded materials, and the conversion is not so complete. The silica grains tend to expand and the clay to contract, nett expansion or contraction depending on the proportions of the constituents "and certain other factors." A small expansion is expected near to 90% SiO_2, contraction near to 80%. The coefficient of expansion is greatest between 200° and 300°C., and again between 500° and 600°C.

Firebrick material typically contains 25–35% alumina, small amounts of fluxing oxides and the balance silica. Some well-known firebricks contain up to 43% alumina. Fireclay contracts in the kiln and in use at high temperatures, and the contractile tendency may persist. Natural fireclays may contain nodules of ferruginous minerals which give rise to the well-known "iron spots"; these may act as catalysts for reactions leading to the disintegration of the brick.

Slag action and erosion is summarized as follows:

(1) Contrasting effects are to be expected according to whether the corroding agent is in the solid, liquid, or vapour phase, and depending on the surface temperature (and temperature gradient) of the refractory.

(2) Fluxing reagents commonly found in carbonizing practice may be divided into two groups:

(*a*) The low temperature fluxes which form eutectics with silica below 1,200°C. These are iron, sodium and potassium compounds, and they have direct action on the slagging of the refractory.

(*b*) The high temperature fluxes whose eutectics occur mainly above 1,400°C., and hence are not responsible for direct attack on the refractory, but which may play a secondary part in modifying the properties of slags formed under the action of the low temperature fluxes. This group includes magnesia and titanium oxide.

(3) The reaction products of alkalis with alumino-silicates melt, on the whole, at higher temperatures than the alkali silicates. Sodium alumino-silicates in general have lower melting-points than potassium alumino-silicates.

Action of Alkalis

"In spite of the comparatively low melting-points of the alkali silicates, which might be construed as indicating but little resistance of silica materials to alkali action, silica products are generally preferred to fireclay for use in the carbonization of coals containing alkali chlorides." Details are given of the experimental work. Silica bricks are contrasted with fire-bricks, in regard to the action of alkalis, as follows:

(1) Alkali silicates melt at lower temperatures than alkali alumino-silicates. At about 1,000°C. this may confer protection on silica materials against further alkali salt vapour attack, but not against such molten alkali compounds (*e.g.*, carbonate, hydroxide) as do not require an accessory reagent (water, oxygen) for reaction to proceed.

(2) Alkali chlorides under dry conditions react with silica bricks less easily than with firebricks.

(3) Expansile and disruptive effects of alkali chlorides are exhibited at 1,000°C. by firebricks, but not so markedly by silica bricks.

PART II.

Failures Occurring in Carbonizing Plant

General.—Leaks and cracks may develop through (*a*) unequal settling of foundations; (*b*) movements due to reversible expansion, which are generally more readily calculable, enabling allowances to be made; (*c*) expansion stresses set up (in silica material) when heating up, particularly through the critical range 200°–300°C.; (*d*) pressure exerted by the expansion of the charge (strongly swelling coals). Sound joints depend on suitable jointing cements, important properties of which are workability, drying shrinkage, grain size, and, after firing, shrinkage strength, porosity, permeability, and refractoriness. A cement expanding slightly both in firing and in use is preferred to one which contracts, though considerable volumetric changes in either direction are undesirable. Grain size, 30 mesh, is generally satisfactory. Workmanship, perhaps the most important factor, is the most difficult to control. Thin joints should be the rule, and recent tests suggest that cements are best used in as wet a condition as practicable.

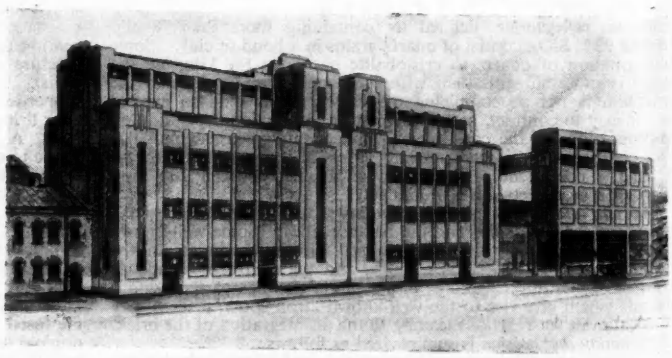
Repairs are briefly referred to. No great success has been obtained with hot patching. The spray-welding of Rhead, Hawthorn and Deacon is briefly described. The main objection appears to be that the fused material has different physical properties from those of the original brickwork, so that any temperature changes may cause it to break away. The method is, however, being used in many gas-works. "It is particularly interesting . . . that work on patching

GLOVER-WEST *Vertical Retorts at* COVENTRY

"It is no longer considered necessary that the buildings housing Gas Works plant should be of a purely utilitarian character. For comparatively little extra expenditure it is possible for these buildings to be of such a character as to maintain and even raise the prestige of the Gas Industry in the eyes of the consumer and of the public as a whole."

COMMUNICATION No. 230—PROCEEDINGS OF THE INSTITUTION OF GAS ENGINEERS, 1939-40.

In this photograph of the fourth Installation of Glover-West Vertical Retorts at the Foleshill Works, Coventry, the coke storage hoppers with screening plant above are seen in the foreground. The retort house lies to the left. Space between is reserved for the duplication of the carbonizing plant. The project for the complete installation is sketched below.



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and sealing retorts is continuing, and that more efficient methods are being developed."

Continuous Verticals

Slagging occurs in the bottom third of the retort. The incidence and distribution of slagging appears to be influenced by the position of maximum temperature and the admission of steam. "Slagging attack is due to the interaction between the refractory material and the fluxing agents present in the coal ash such as alkalis, iron oxide and lime."

Two points are noted: (1) the main attack occurs in zones of silica in contact with steam, in the lower courses, particularly at the gas off-take end (in the higher courses where temperatures are higher there is no slag attack); (2) a sharp line of demarcation between the attacked silica and the unattacked fireclay below it.

Flaking is a form of erosion in which thin flakes of brick (ranging from mere films to ½ in. or more thick) fall away during scurfing, often attached to pieces of scurf. It occurs in a zone coinciding roughly with the area of scurf deposition. Flaking appears to be restricted to the silica materials, and the zone varies in extent and intensity with varying systems of heating.

The top fireclay section is liable to weakness of two kinds, the first characterized by vitrification and crazing of the material, possibly caused by excessive temperature and absorption of fluxing vapours, the second, a crumbling which may be due to attack by fluxing vapours at too low a temperature for fusion to occur.

Horizontal Retorts and Coke Ovens

Slagging mostly occurs on the bottom of horizontal retorts and over its full length with the exception of the end sections. Evidence suggests that silica stands up better to slagging than either siliceous or fireclay materials, but long life has been obtained with siliceous goods.

Similarly, slagging occurs on the lower part of coke oven walls and on the sole. An important factor may be the presence of water in the charge, which has an effect analogous to that of steaming in verticals.

SUMMARIZING.

(1) Slagging of silica is common to all three types of plant.

(2) In each case it is associated with the presence of steam or water. Alkali chlorides may penetrate into silica material before reaction occurs (in the dry state), resulting in the formation of a protective glaze on the grains, but, in the presence of steam, fusible compounds are formed nearer the surface, resulting in slagging and erosion.

(3) Flaking occurs in two forms, both confined to the scurfing zone of continuous verticals. In the one the surface of the brick is attacked chemically and then removed mechanically by the scurf. In the other the cause appears to be wholly physical.

The importance is emphasized of carefully collected and correlated data obtained over the whole life of each carbonizing plant.

Gas Undertakings' Results

Bath Gas Company.—Sales of gas in 1945 showed a reduction compared with the previous year, but this was accounted for by the cessation of one temporary wartime consumption. Apart from this the sales of gas were slightly higher than in 1944, in spite of the frequent appeals for economy in the use of fuel. Income from gas sales amounted to £343,546, against £352,283 in the previous year, and the balance carried to profit and loss account was £34,721, against £36,846. A final dividend of 2½%, making 5% for the year, was declared at the annual meeting on Mar. 20, leaving £31,633 to be carried forward compared with £28,857 brought in. The Directors stated in their report that it had not been possible to secure any further revision of basic prices, and the present basic prices did not permit the payment of a dividend at a higher rate than 5%.

Haywards Heath District Gas Company.—A final dividend of £4 3s. 9d.%, less tax, the same as for the half-years to June 30, was declared at the annual meeting on Mar. 19. Gas sales for 1945 totalled 833,009 therms, and yielded £45,014. Of a total revenue of £68,503 the balance carried to profit and loss account was £9,377. The balance of net profit was £4,088, and the payment of the dividends leaves £2,553 to be carried forward, against a net balance of £2,338 brought in.

Kettering Gas Company.—The turnover for 1945 showed an increase on the previous year and constituted another record. Against the increased income was an increase in the price of bulk gas and in the price of coal consumed at the Burton Latimer carbonizing plant. In recommending a final dividend of 4%, making 7½% for the year, the Directors reported at the annual meeting on April 2 that they had carefully considered not only the present earning capacity of the Company but had given thought to the future, and were satisfied that 7½% should be maintained. The Chairman, Mr. T. N. Bird, said many customers were anxious to have gas refrigerators; hot water units over sinks were also urgently wanted and domestic hot water and central heating were increasingly required. With regard to nationalization, Mr. Bird said the Company had been serving its customers for over 100 years and held a good record. It seemed to him that all of them were more favourably circumstanced under their steady progressive policy than would be the case under nationalization. The Industry itself was in favour of evolution, but was in profound disagreement with State control, because the absence of competition would lead to increased costs and inferior service.

Lea Bridge District Gas Company.—Net revenue for 1945, after providing for debenture interest and all other expenses, amounted to £31,663. Gas sales totalled 5,981,386 therms and brought in £270,339 compared with 5,866,854 therms (£240,613) in 1944. The balance carried to net revenue account was £58,014, against £56,411. At the annual meeting on April 3 dividends at standard rates were declared on the various Preference stocks and at 7¾% on the Consolidated Ordinary stock, leaving £30,715 to be carried forward, against £12,587 brought forward from 1944.

Leamington Priors Gas Company.—Presiding at the annual meeting on Mar. 26, Dr. Harold Mason said the net balance of £11,977 on profit and loss account showed an increase of £461 over the commencing balance. Gas sold in 1945 totalled 616 million cu.ft., representing an increase of approximately 1% over 1944, and 30% over 1939. It was unfortunate that during the war years they were not able to increase the capacity of their distribution system to correspond with the increasing demand for gas. Pressure difficulties were bound to follow, and orders had been placed for additional mains in order to overcome them. Dividends for the half-year ended Dec. 31 at the rate of 10% per annum on the "A" Ordinary shares and 7% per annum on the "B" and "C" Ordinary shares, less tax, were declared. Dr. Mason presented examination awards to 20 members of the Gas-Works Division of the St. John Ambulance Brigade, and diplomas for accident-free driving to the Company's five horse and lorry drivers.

Perth (Australia) Gas Department.—The annual report and statement of accounts of the City of Perth Electricity and Gas Department for the year ended Sept. 30, 1945, show gas sales totalling 724,537,412 cu.ft., compared with 665,968,483 cu.ft. for the previous year. The maximum daily output was 2,697,000 cu.ft. on July 31. The number of meters increased from 34,671 to 35,709, an increase of 1,038 for the year. Total receipts were £789,873, against £742,141, and gross profits were £97,804, against £98,100. The amount contributed by the department to date to loan repayments totals £896,963. Coal shortages gave cause for anxiety throughout the year and, because, of the mixed nature of the coals, made working difficult. General statistics are included in the report showing the progress of the department since 1912, when gas sales to 1,840 consumers totalled 55,197,300 cu.ft. Sales increased steadily each year until 1932, when there was a slight setback from 315,894,000 cu.ft. to 292,982,700 cu.ft., but by 1935 the 1931 record had been passed and the sales have since shown consistent increases. Sales in 1916 totalled 93,297,600 cu.ft., to 3,792 consumers; in 1926 they reached 185,816,600 cu.ft., to 8,287 consumers; and in 1936 the total was 358,832,164 cu.ft., and consumers numbered 21,804.

Tottenham and District Gas Company.—Gas sales at 30,631,647 therms showed an increase of 3.75% for the year, yielding £1,557,483, against £1,382,660 for the previous year. By-products brought in £541,751 against £459,711, and rentals of meters, appliances and fittings totalled £207,001 against 190,979. To meet increased coal costs the Directors found it necessary to increase the price of gas from June by 0.3d. per therm. As already announced, the final dividend is 2½%, making 5% for the year. After payment of dividends and co-partnership bonus, provision for taxation in respect of the current year's profits, amounting to £160,634, further provision for war damage contribution amounting to £5,907, and £80,000 towards the cost of reconstructing the works at Ponders End, the amount added to the carry-forward is £3,528.

Dividends

Colonial Gas Association.—At a recent meeting of the Directors, nterim dividends were declared for the half-year ended Dec. 31 at the rate of 4% (Australian currency), less tax, on the Preference Shares, and 2½% (Australian currency), less tax, on the Ordinary shares, and less deduction for rate of exchange. The dividends were payable in Melbourne on April 4, but as regards shareholders on the English register, it will not be possible, owing to the uncertainty as to the rate of exchange ruling at the date of declaration of dividend, for these to be paid until about the middle of the month.

Malta and Mediterranean Gas Company.—The Directors have declared an interim dividend, payable on or shortly after April 16, of 3½% on the First Preference stock, 3¾% on the Second Preference stock, less tax, and 2½%, free of tax, on the Ordinary stock.

The Temporary Address of the Colonial Gas Association is 12, Grand Avenue (not Grand *Parade*, as announced in our issue of Mar. 27), Hove, Sussex.